

WHAT IS CLAIMED IS:

1. A manufacturing method of a gas discharge panel having a discharge space in between a pair of substrates sealed together with a sealant, comprising sequentially the steps of:

5 a first step to form the sealant in a frame-shape on at least one of the substrate, and to stack said substrate onto another substrate via the sealant;

10 a second step to lower a pressure in a space existing between the pair of substrates by exhausting the space and within the sealant, while the sealant is melt by being heated;

a third step to solidify the sealant so as to fix the pair of the substrates as well to form a predetermined discharge space;

15 a fourth step to remove an impurity in the discharge space; and

a fifth step to fill a discharge gas into the discharge space.

2. A manufacturing method of a gas discharge panel as recited in claim 1, wherein in the second step an exhausting of the space is begun when the sealant reaches a predetermined melting temperature thereof, and the sealant is pressed by holding a predetermined low pressure in the space so as to define a gap between the pair of the substrates.

25 3. The manufacturing method of a gas discharge

panel as recited in claim 1, wherein a exhausting process for lowering a pressure in a space in between the substrates and a heating process for melting the sealant are begun simultaneously

4. A manufacturing method of a gas discharge panel as recited in ^{claim 1} ~~either one of claim 1 to claim 3~~, wherein in the second step are provided separator walls for defining the discharge space on at least one of the substrates so that said separator walls define said gap of the space when the pair of substrates press the sealant.

5. A manufacturing method of a gas discharge panel as recited in ^{claim 1} ~~either one of claim 1 to claim 4~~, wherein a non-continuous barrier wall is provided beforehand in a vicinity of inside the sealant so as to prevent an inward invasion of the sealant melted.

6. A manufacturing method of a gas discharge panel as recited in ^{claim 1} ~~either one of claim 1 to claim 5~~, wherein in said first step said frame-shaped sealant is formed of a plurality of frames thereof on said one of substrates; and

said steps 2 to 5 are carried out for said frames and for a plurality of spaces formed with said frames.

7. A manufacturing method of a gas discharge panel as recited in claim 6, wherein each of said spaces formed of said sealant frame is provided with a through hole in the vicinity where each of portions of adjacent said spaces gathers; so that said

exhausting and said discharge gas filling process are carried out via a pipe connected commonly to each through hole.

a 5 8. A manufacturing method of a gas discharge panel
as recited in ^{claim} ~~either one of claim 1 to claim 7~~, wherein in said first step
peripheral portions of said pair of substrates are pinched with
tentatively fixing clips.

10 9. A manufacturing method of a gas discharge panel
having a discharge space in between a pair of substrates sealed
together with of a sealant, comprising sequentially the steps of:

15 a first step to form a plurality of the sealant each in a
shape of frame at least on a surface of a substrate opposing to another
substrate, and to stack said substrate onto another substrate via a
plurality of the sealant, wherein each of the substrates is formed of
parts for composing the panels within each of reigns which are defined
by a plurality of cutting lines, and each of the shapes formed with the
sealant is formed so as to enclose a corresponding reign;

20 a second step to lower each of pressures in a plurality of
spaces formed in between the pair of substrates due to the existence of
the plurality of sealant so as to press over the surfaces of the pair of
the substrates and to fix a gap between the pair of the substrates while
the plurality of sealant is melt by being heated;

25 a third step to solidify the plurality of the sealant once
being melted so as to fix the pair of the substrates as well to form the
discharge spaces in between the pair of substrates;

a fourth step to remove an impurity in the discharge spaces;

a fifth step to fill a discharge gas into the discharge spaces; and

5 a sixth step to cut the pair of the substrates along the cutting lines into a plurality of smaller substrates so as to form a plurality of smaller discharge panels.

10. The manufacturing method of a gas discharge panel as recited in 9, wherein each of said spaces formed of said sealant frame is provided with a conduction pipe in a portion, said portions each are in a vicinity and in each of adjacent space each other, so that said exhausting and said discharge gas filling process are carried out via a pipe connected commonly to each the conduction pipe.

15 11. A manufacturing method of gas discharge panel provided with a sealed pair of substrates opposing to each other, one of the substrates having a plurality of electrodes on an inner surface thereof so as to produce a discharge with adjacent electrodes, and the
20 another of the substrates having on an inner surface thereof fluorescent materials of a plurality of color kinds for emitting fluorescences stimulated by the discharge and a plurality of separator walls formed of in predetermined pattern so as to separate said fluorescent materials, comprising of a step:

25 a step for sealing said pair of the substrates, wherein said step includes a first process to form a sealant at a periphery of the

other substrate higher than that of said separator walls, a second process to exhaust a gap in between the pair of the substrates opposing each other till a beginning of said sealant melting, and in turn a third process to heat said sealant till said sealant to be melt while the gap is
5 hold in low-pressure therein by said exhausting.

12. A manufacturing method of a gas discharge panel having a pair of substrates sealed at a periphery thereof, said pair of substrates having a plurality of electrodes on each substrates and
10 opposing to each other via a predetermined discharge space therebetween, comprising the steps of:

a first step to exhaust said discharge space via a leak-clearance between a seal-glass layer and the substrate while an inner space of the furnace is kept at predetermined temperature, wherein
15 said seal-glass layer is formed on a periphery of one of the substrates, said each of the substrates being kept at predetermined interval therebetween is held in a vacuum-heating furnace;

a second step to seal said pair of the substrates during lowering a pressure in an opposition-space in between the pair of the
20 substrates via a conduction pipe connected to a through hole previously provided in a portion of another substrate while the temperature in the inner of the furnace raises to a melting temperature of said seal-glass layer.

25 13. The manufacturing method of a gas discharge panel as recited in claim 12, wherein a pressure around said pair of the

substrates is raised once at least in process of said lowering a pressure around the pair of the substrates before melting of said seal-glass layer.

5 14. The manufacturing method of a gas discharge panel as recited in claim 12, wherein said lowering the pressure via a seal-head connected to the conduction pipe.

10 15. A manufacturing method of a gas discharge panel, said panel having a sealant and a plurality of separator walls so as to keep a discharge space on at least one of a pair of substrates and the pair of the substrates being sealed by the sealant, comprising sequentially steps of:

a first step to form a frame-shape sealant on one at least of the substrates, and to stack the substrate onto another substrate;

15 a second step to arrange a formed-glass-frit in a vicinity of a through hole provided to one at least of the substrates;

20 a third step to heat the pair of the substrates so as to raise a temperature of the pair of the substrates by heating, and to exhaust a gas and lower a pressure around the pair of the substrates so as to remove a impurity in a space in between the substrates;

a fourth step to melt the sealant;

a fifth step to form said discharge space in a height determined by that of the separator walls due to deforming the sealant;

25 a sixth step to cool the pair of the substrates so as to solidify the sealant;

a seventh step to fill the space with a discharge gas;
a eighth step to seal the through hole used for filling the
discharge gas into the discharge space.

5 16. The manufacturing method of a gas discharge
panel as recited in claim 15, wherein in the first step a height of the
sealant is formed higher than that of the separator walls, clips for
pinching and fixing said the pair of the substrates are located so as to
10 press portions within a vicinity of regions where the separator walls,
and the discharge space is formed via each step from the first to fifth
steps being carried out while the sealant is applied with a force due to
bending of the substrates.

15 17. The manufacturing method of a gas discharge
panel as recited in claim 15, wherein in the fifth step is caused a force
toward the discharge space from an exterior around the pair of the
substrates due to a pressure around the pair of the substrates being
kept higher than that in the discharge space.

20 18. The manufacturing method of a gas discharge
panel as recited in claim 15, wherein in the fifth step is closed a
portion in a conduction path from the discharge space to the exterior of
the pair of the substrates so as to provide a uniform pressure-
difference between the pressure in the discharge space and that in the
25 exterior of the pair of the substrates.

19. The manufacturing method of a gas discharge panel as recited in claim 15, wherein in the third step an exhausting of an exterior around the pair of the substrates is begun when the sealant reaches a vicinity of temperature at which a degassing becomes active
5 and is ended when the sealant sticks to the substrate.

20. The manufacturing method of a gas discharge panel as recited in claim 15, wherein a conduction pipe is connected to the through hole, and a seal-head available to exhaust the discharge
10 space via the conduction pipe is connected to the conduction, and an exhausting the discharge space is carried out via the conduction pipe and the seal-head after the sealant sticking to the substrate.

21. The manufacturing method of a gas discharge panel as recited in claim 15, wherein in the fourth step the pressure
15 around the pair of the substrate is raised to a level of pressure at which a bubble existing in a sealant does not grow bigger.

22. The manufacturing method of a gas discharge panel as recited in claim 20 wherein after the pressure around the
20 pair of the substrate is raised to a level of pressure at which a bubble existing in a sealant does not grow bigger.

23. The manufacturing method of a gas discharge display panel as recited in 15, wherein in the fourth step the sealant is
25 melted in a temperature below a beginning of softening of the sealant

so as to prevent a bubble in the sealant from growing.

24. The manufacturing method of a gas discharge display panel as recited in 15, wherein a conduction pipe is bonnected
5 to the through-hole, and a seal head available to exhaust the discharge space is connected to the conduction pipe after the sealant is dolidified and cooled so as to introduce a discharge gas into the discharge space.

25. The manufacturing method of a gas discharge
10 display panel as recited in 20, wherein the seal-head having a heater to heat the conduction pipe melts a part of the conduction pipe by heating after introducing of the discharge gas into the discharge space via the conduction pipe so as to seal the discharge space.

26. The manufacturing method of a gas discharge display panel as recited in 25, wherein a pressure in a ambient of the pair of the substrates or the part of the conduction pipe to be melt is raised to a higher pressure than that in the discharge space when the part of the conduction pipe is melt.

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